SUPPLEMENT 2-B

EVOLUTIONARY ACQUISITION CONSIDERATIONS

The evolutionary approach to defense acquisition is the simple recognition that systems evolve as a result of changing user needs, technological opportunities, and knowledge gained in operation. Evolutionary Acquisition is not new to military systems. No naval ship in a class is the same; aircraft and vehicles have block changes designed to improve the design; variants of systems perform different missions; satellites have evolutionary improvements between the first and last launched; and due to fast evolving technology, computer resources and software systems are in constant evolution.

As shown by Figure 2-8, evolutionary acquisition starts with the development and delivery of a core capability. As knowledge is gained through system use and as technology changes, the system is evolved to a more useful or effective product. At the beginning of an evolutionary acquisition the ultimate user need is understood in general terms, but a core need that has immediate utility can be well-defined. Because future events will affect the eventual form of the product, the requirements can not be fully defined at the program initiation. However, the evolutionary development must be accomplished in a management system that demands
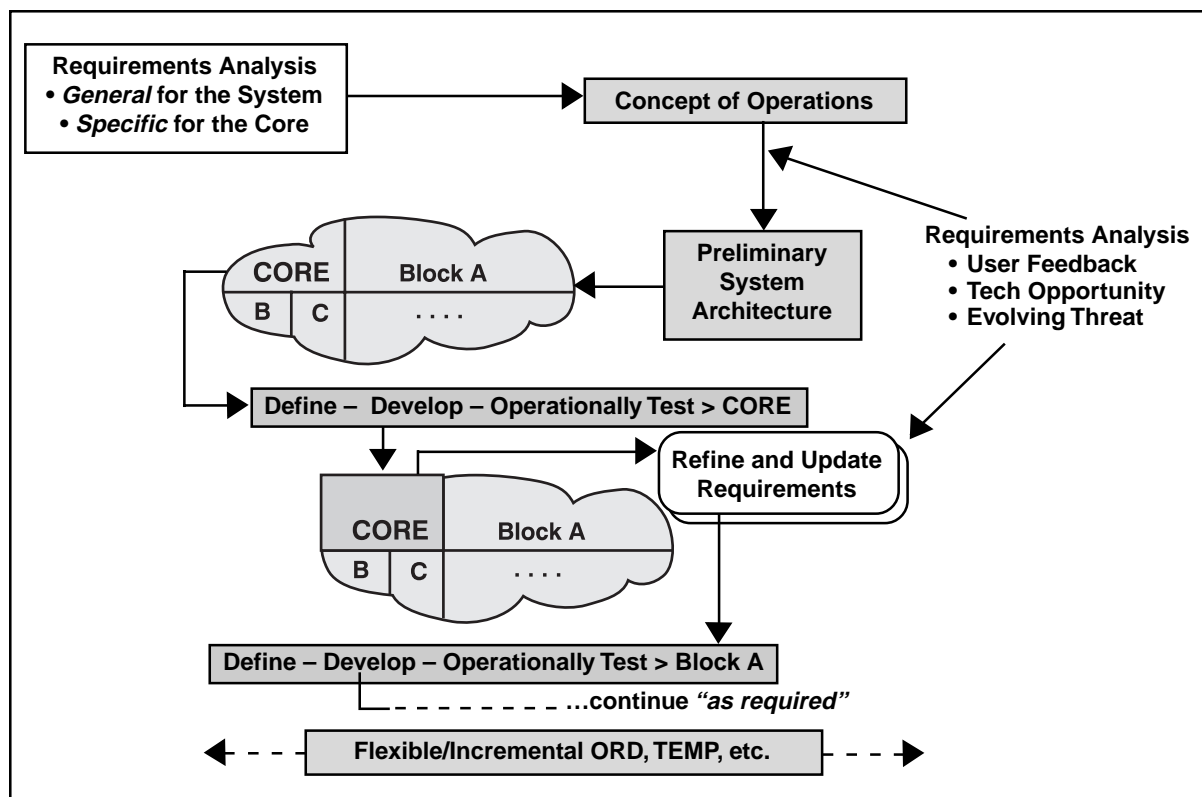

Figure 2-8. Evolutionary Acquisition

requirements validation, fully funded budgets, and rigorous review. In addition, the systems engineering function remains responsible for controlling requirements traceability and configuration control in the absence of complete definition of all requirements or final configurations. These constraints and concerns require the evolutionary approach be accomplished in a manner such the various concerns of users, developers, and managers are adequately addressed, while the risks associated with these issues are mitigated.

Acquisition Managment

Acquisition management requirements established in the DoD 5000 documents and associated component regulations or instructions establish a series of program-specific analyses, reports, and decision documents that support the milestone decision process. In addition, prior to decision points in the acquisition process, substantial coordination is required with an array of stakeholders. This process is resource consuming but necessary to establish the program's validity in the eyes of those responsible to approve the public resources committed to the program.

Evolutionary acquisition, by its nature, represents an "acquisition within an acquisition." On one level, the engineering manager is confronted with the management and control of the system as it progresses to its eventual final configuration, and, on another level, there is the management and control of the modifications, or blocks, that are successively integrated into the system as they are developed. The system has associated requirements, baselines, reviews—the normal elements of a system acquisition; however, each block also has specified requirements, configuration, and management activities. The challenge for technical management then becomes to ensure that good technical management principles are applied to the development of each block, while simultaneously ensuring that the definition and control of requirements and baselines at the system level include and accommodate the evolving architecture.

System Engineering Concerns

Evolutionary acquisition will require incremental and parallel development activities. These activities are developing evolutionary designs that represent a modification as well as an evolved system. The evolutionary upgrade is developed as a modification, but the new evolved system must be evaluated and verified as a system with new, evolved requirements. This implies that, though we can enter the acquisition process at any point, the basic baselining process required by systems engineering must somehow be satisfied for each block upgrade to assure requirements traceability and configuration control.

As shown by Figure 2-9, incremental delivery of capability can be the result of an evolutionary block upgrade or be an incremental release of capability within the approved program (or current evolutionary block) baseline. System engineering is concerned with both. There is no check list approach to structure these relationships, but the following is presented to provide some general guidance in a difficult and complex area of acquisition management planning and implementation.

Evolutionary upgrades may be based on known operational requirements where delivery of the capability is incremental due to immediate operational need, continuing refinement of the product baseline prior to full operational capability, and pre-planned parallel developments. If the modification is only at the allocated or product baseline, and the program's approved performance, cost, and schedule is not impacted, then the system would not necessarily require the management approvals and milestones normal to the acquisition process.

In all cases, the key to maintaining a proper systems engineering effort is to assure that architectures and configuration baselines used for evolutionary development can be upgraded with minimal impact to documented and demonstrated configurations. The risk associated with this issue can be significantly reduced through program planning that addresses optimization of the acquisition baseline and control of the evolving configuration.
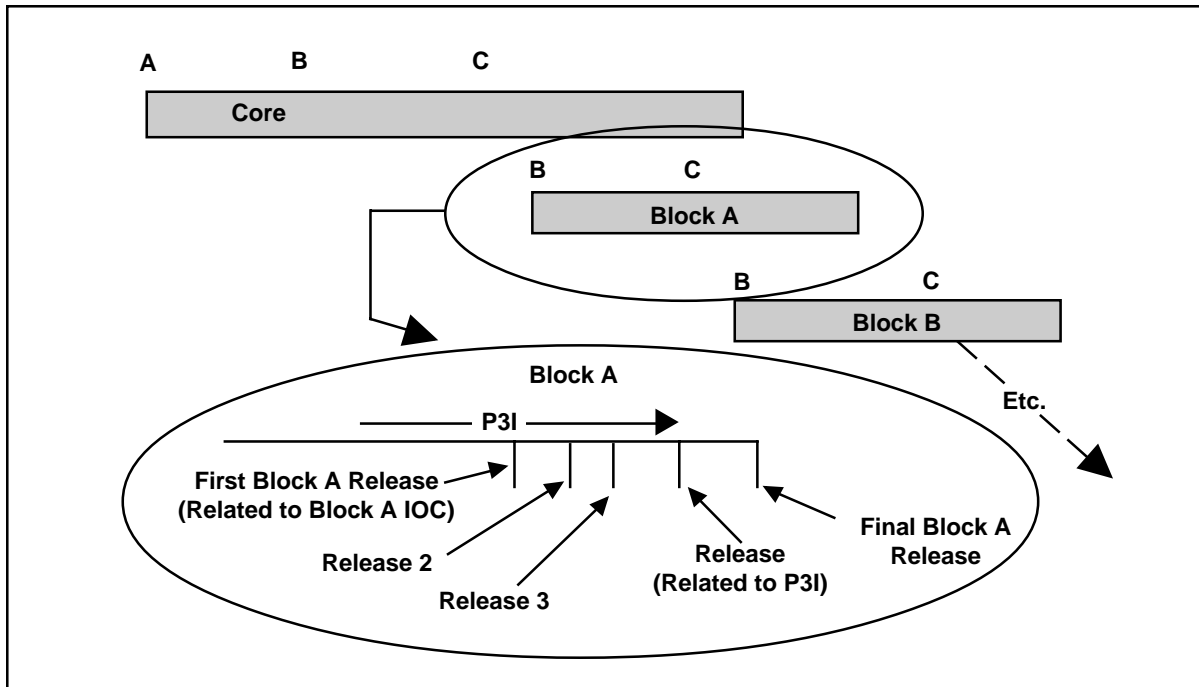
Figure 2-9. Incremental Release Within Evolutionary Blocks

Planning

Evolutionary acquisition program planning must clearly define how the core and evolutionary blocks will be structured, including:

1. A clear description of an operationally suitable core system including identification of subsystems and components most likely to evolve.

2. Establishment of a process for obtaining, evaluating and integrating operational feedback, technology advancements, and emerging commercial products.

3. Planning for evolutionary block upgrade evaluation, requirements validation, and program initiation.

4. Description of the management approach for evolutionary upgrades within a block and the constraints and controls associated with incremental delivery of capability.

5. Risk analysis of the developmental approach, both technical and managerial.

Systems engineering planning should emphasize:

1. The openness and modularity of the design of the core system architecture in order to facilitate modification and upgrades,

2. How baseline documentation is structured to improve flexibility for upgrade,

3. How evolutionary acquisition planning impacts baseline development and documentation control,

4. How technical reviews will be structured to best support the acquisition decision points, and

5. How risk management will monitor and control the management and technical complexity introduced by evolutionary development.

The basic system architecture should be designed to accommodate change. Techniques such as open architecting, functional partitioning, modular design, and open system design (all described later in this book) are key to planning for a flexible system that can be easily and affordably modified.

27

Notional Example of Evolutionary MAIS Acquisition Relationships					
Characterization	**System Level**	**Acquisition Program Level**	**Acquisition Documentation Required**	**Baseline**	**CM Authority**
Overall Need	Major Program or Business Area	Capstone or Sub-Portfolio	Capstone Acquisition Documentaion	Top Level Functional Baseline	PMO
Core and Evolutionary Blocks	Build or Block of Major Program	Acquisition Program	Full Program Documentation	Cumulative Functional and Allocated Baseline	PMO with Contractor Support
Incremental Delivery of Capability	Release or Version of Block	Internal to Acquisition Program	Separate Acquisition Documentation Not Required	Product Baseline	Contractor (Must Meet Allocated Basleine)
Associated Product Improvements	Application or Bridge	Parallel Product Improvement (Less than MAIS)	Component or Lower Decision Level Acquisition Processing	Functional, Allocated, and Product Baselines	PMO/Contractor

Table 2-1. Evolutionary Acquisition Relationships

Example

Table 2-1 illustrates some of the relationships discussed above as it might apply to a Major Automated Information System (MAIS) program. Due to the nature of complex software development, a MAIS acquisition inevitably will be an evolutionary acquisition. In the notional MAIS shown in the table, management control is primarily defined for capstone, program, subsystem or incremental delivery, and supporting program levels. The table provides relationships showing how key acquisition and system engineering activities correlate in the evolutionary environment. Probably the most important lesson of Table 2-1 is that these relationships are complex and if they are not planned for properly, they will present a significant risk to the program.

Summary

Acquisition oversight is directly related to the performance, cost, and schedule defined in the acquisition baseline. It establishes the approved scope of the developmental effort. Evolutionary development that exceeds the boundaries established by the acquisition baseline requires a new or revised acquisition review process with additional oversight requirements. The development and approval of the ORD and Acquisition Program Baseline are key activities that must structure an evolutionary process that provides user and oversight needs, budgetary control, requirements traceability, risk mitigation, and configuration management.